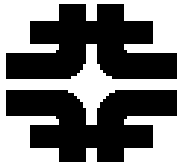


Fermilab

Fermilab Proton Driver Workshop/Physics Study

1. Introduction
2. Organization / Working Groups
3. Workshop Conclusions
4. Advisory Committee & Reviews
5. Future
6. Getting Involved

Introduction

Following the recommendations of the Fermilab Long Range Planning Committee, the Fermilab Director has requested:

"Preparation of documentation sufficient to establish mission need for the Proton Driver as defined by the Department of Energy CD-0 process."

"Development and documentation of the physics case. I would like this to include both support for a forefront neutrino program at Fermilab in the decade 2010 and beyond, and identification of other opportunities that could potentially be enabled with a Proton driver facility."

Proton Driver Physics Study
Working Groups and Conveners

WG1: Neutrino Oscillations
D. Harris (FNAL), S. Brice (FNAL), W. Winter (Princeton)

WG2: Neutrino Interactions
J. Morfin (FNAL), R. Ransome (Rutgers), R. Tayloe (Indiana)

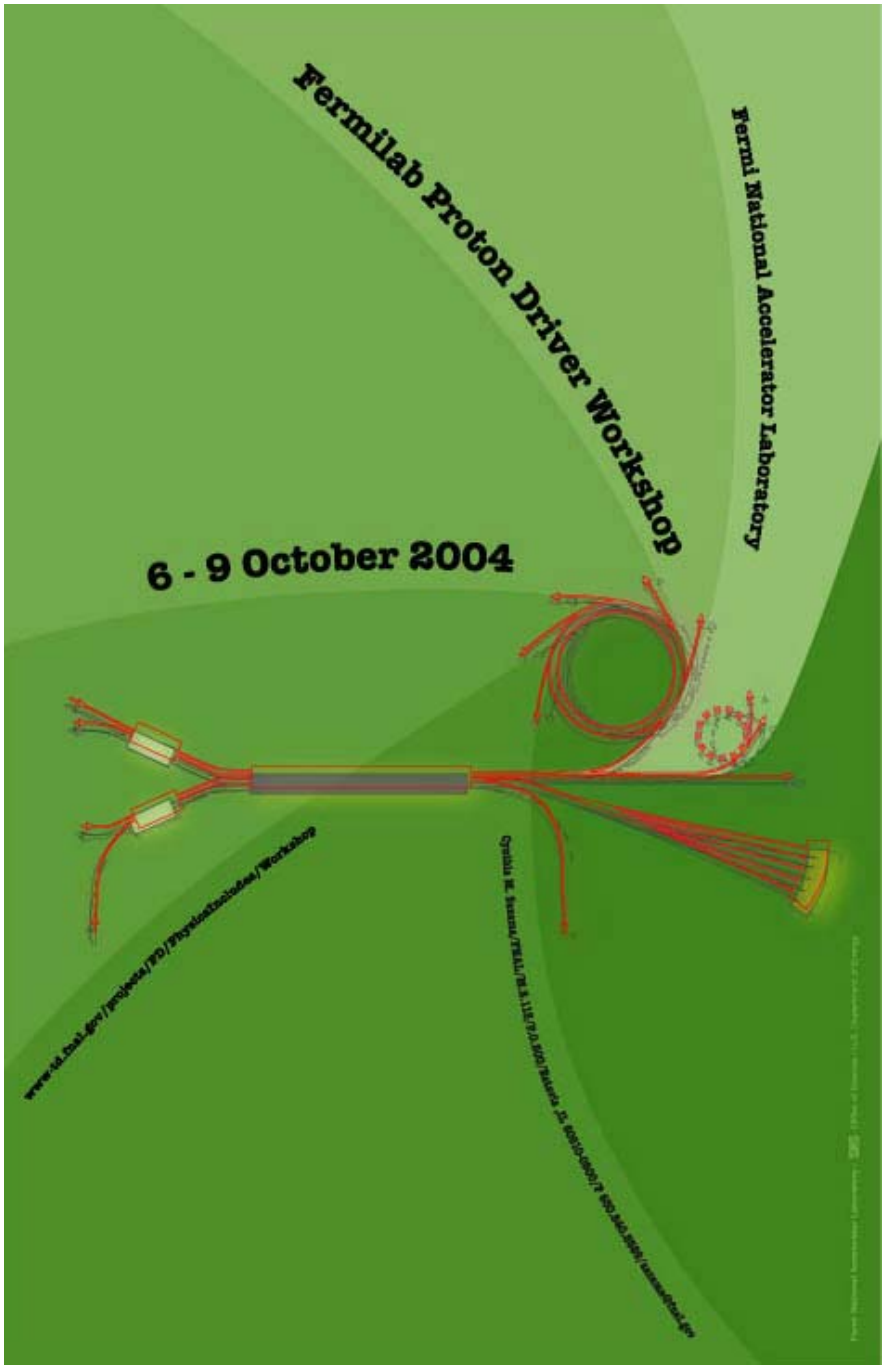
WG3: Muons
R. Ray (FNAL), R. Roberts (BU)

WG4: Kaons and Pions
H. Nguyen (FNAL), T. Yamanaka (Osaka U.)

WG5: Antiprotons
D. Christian (FNAL), M. Mandelkern (UCI)

WG6: Tevatron Collider
H. Cheung (FNAL), Penny Kasper (FNAL), P. Ratoff (Lancaster U.)

WG7 Neutrons
T. Bowles (LANL), G. Greene (ORNL)



October Workshop

Fermilab Proton Driver Physics Workshop, 6-9th October, 2004

133 participants

Lots of good talks & enthusiasm for a Proton Driver physics program

Talks and workshop details:
http://www-td.fnal.gov/projects/PD/Physics.html

October Workshop

Wednesday 6 October		
Chair: Steve Holmes		
08:30	Welcome	M. Witherell
08:40	Brief Organizational Things ppt pdf	S. Geer
08:45	Proton Driver Introduction ppt pdf	R. Kephart
09:15	Machine Parameters ppt pdf	W.Foster
09:45	Discussion	
10:00	Coffee Break	
Chair: Chris White		
10:20	Neutrino Physics + APS Neutrino Study Report ppt pdf	B.Kayser
10:50	CERN SPL: Parameters and Program ppt pdf	V.Palladino
11:20	JPARC: Parameters and Program ppt pdf	J.Imazato
11:50	Discussion	
12:15	Lunch	
Chair: Jonathan Rosner		
14:00	BNL Upgrade: Parameters and Program pdf	W. Marciano
14:30	Working Group Plans (6 groups x 5 mins/group + 30 mins discussion)	
15:30	Coffee Break	

Thursday 7 October		
Chair: Chris Quigg		
08:30	INFN High Intensity Frontier Study ppt pdf	D.Bettoni
09:00	Physics with an Intense Proton Source ppt pdf	J. Ellis
09:30	Accelerator-Based Particle Astrophysics ppt pdf	P.Chen
10:00	Coffee Break	
10:30	Working Group Sessions 2	
12:30	Lunch	
14:00	Working Group Sessions 3	
15:30	Coffee Break	
15:50	Working Group Sessions 4	

Friday 8 October		
Chair: Mike Shaevitz		
09:00	Neutron Physics ppt pdf	G.Greene
09:30	Medical Physics at a Proton Source ppt pdf	A.Lennox
10:00	Coffee Break	
10:30	Working Group Sessions 5	
12:30	Lunch	
14:00	Working Group Sessions 6	
15:30	Coffee Break	
15:50	Working Group Sessions 7	

Picture Emerging from October Workshop

1. Neutrino Oscillation physics is driving the interest in a Proton Driver. The physics case seems very strong.
2. The neutrino oscillation program needs continued progress in neutrino scattering measurements → needs to be one or more neutrino scattering experiments. Neutrino scattering is interesting in its own right & will broaden the program
3. Low energy muon physics could provide an exciting additional physics program … but a muon source needs to be designed.
4. Precision kaon and pion measurements may also provide interesting additional experiments, although using the intensity will be a challenge.
5. Other possibilities: Some specialized neutron physics experiments, antiprotons (?), medical physics (?), ….

Saturday 9 October		
Chair: Peter Meyers		
08:30	WG1 Summary (25 mins) ppt pdf	
09:00	WG2 Summary (25 mins) ppt pdf	
09:30	WG3 Summary (25 mins) ppt pdf	
10:00	Coffee Break	
Chair: Jeff Appel		
10:20	WG4 Summary (25 mins) pdf	
10:50	WG5 Summary (25 mins) ppt pdf	
11:20	WG6 Summary (25 mins) ppt pdf	
11:50	Concluding Remarks	
12:00	Close	

Proton Driver Scientific Advisory Committee

Peter Meyers (Chair)	Princeton
Ed Blucher	Chicago
Gerhard Buchalla	Munich
John Dainton	UK
Yves Declais	CERN
Lance Dixon	SLAC
Umberto Dosselli	INFN
Don Geesaman	ANL
Geoff Greene	ORNL
Taka Kondo	KEK
Marvin Marshak	Minnesota
Bill Molzon	UCI
Hitoshi Murayama	UC Berkley
James Siegrist	LBNL
Anthony Thomas	JLab
Taku Yamanaka	Osaka

1. Give the emerging physics case a critical review

2. Help us to reach out to a broad community as we develop a constituency excited by the Proton Driver Physics Program

First Review of the Emerging Physics Case

The Working Groups prepared draft working group reports that given to the Proton Driver Scientific Advisory Committee. These reports were then presented to the committee in a review on Dec. 16th

08:40 - 09:00	Closed Session	
09:00 - 10:00	Neutrino Oscillation Group,	Steve Brice
10:10 - 10:40	Neutrino Interactions Group	Jorge Morfin
10:50 - 11:10	Break	
11:10 - 11:30	Antiproton Group	Dave Christian
11:40 - 12:10	Muon Group	Ron Ray
12:20 - 13:30	Lunch Break	
13:30 - 13:50	K/pi Group	Hogan Nguyen
14:00 - 14:20	Neutron Group	Geoff Greene
14:30 - 16:00	Closed Session	
16:00 - 16:30	Close Out	

Comments from the First Review

1. Main case rests on neutrino oscillations
2. There is a generic case to be made for the non-neutrino program - low energy flavor physics is complementary to LHC program
3. Muon and kaon physics programs need further elaboration to show more explicitly how the high fluxes will be used.
4. The neutrino oscillation physics case for a Proton Driver in each imagined future scenario is beginning to look convincing, but there is a need to develop experiment timelines … what do we know at each branch in the roadmap, etc.
5. Need to complete the ongoing 8 GeV beam to NOvA study and get it into the next draft (the existing use of the 8 GeV beam for long-baseline experiments looks "pricey").
6. Need discussion of proton economics, which pieces of the program can run in parallel, is the recycler oversubscribed, … etc

Other areas needing work

In addition to the items arising from the first review there are some additional wish-list items that are on the interface between the experiments and the machine:

1. Muon Source
2. Targetry etc
3. Rebunching

We are beginning to launch some activity on these items, but will need lots of help. These general Proton Driver meetings would be a good forum to discuss these interface items.

New Development

We have been told that, at the end of this FY, the DOE intend to make the CD0 step for a high intensity neutrino program. This will be site-independent.

The DOE already have a proposal from BNL.

As input from Fermilab the DOE will have the physics and machine documentation that is being prepared. We have been told that director-type reviews of the machine and physics would also be helpful.

Near-Term Steps - 1

The individual draft working group reports are being further developed. Aim to complete these very soon.

An overall report that integrates together the individual working group reports is being prepared. It will probably by ~100 pages with a short executive summary. Aim to have the first draft of this report early February, in preparation for the next review.

Near-Term Steps - 2

We hope to have a second Proton Driver Scientific Advisory Group meeting towards the end of February, this time to review the draft integrated document (presenting the physics case for a Proton Driver).

This will (hopefully) prepare the way to finalize the physics case document before delivering it to the Director.

The review should also help us to identify/prioritize further work that will need to be done in the longer term, and satisfy the need for a director-type review.

We are beginning to plan the next workshop

2004 Proton Driver Workshop List

- **BNL/UCLA –APS workshop**
  - –BNL, March 3-5, 2004
  - –http://www.bnl.gov/physics/superbeam/presentations.asp
- **Physics with Multi-MW Proton Source (SPL)**
  - –CERN, May 25-27, 2004
  - –http://physicsatmwatt.web.cern.ch/physicsatmwatt/
- **HIF04**
  - –Elba Italy, June 2004
  - –http://www.pi.infn.it/pm/2004/
- **APS Neutrino Study** (year long effort)
  - –www.interactions.org/neutrinostudy
- **Fermilab Proton Driver Physics Workshop**
  - –Fermilab Oct 6-9, 2004
  - –http://www-td.fl.gov/projects/PD/PhysicsIncludes/Workshop/index.html

Future Workshops

We would benefit from some sort of workshop series (new or existing) to develop the ideas, and eventually → prototype collaborations and LOI's

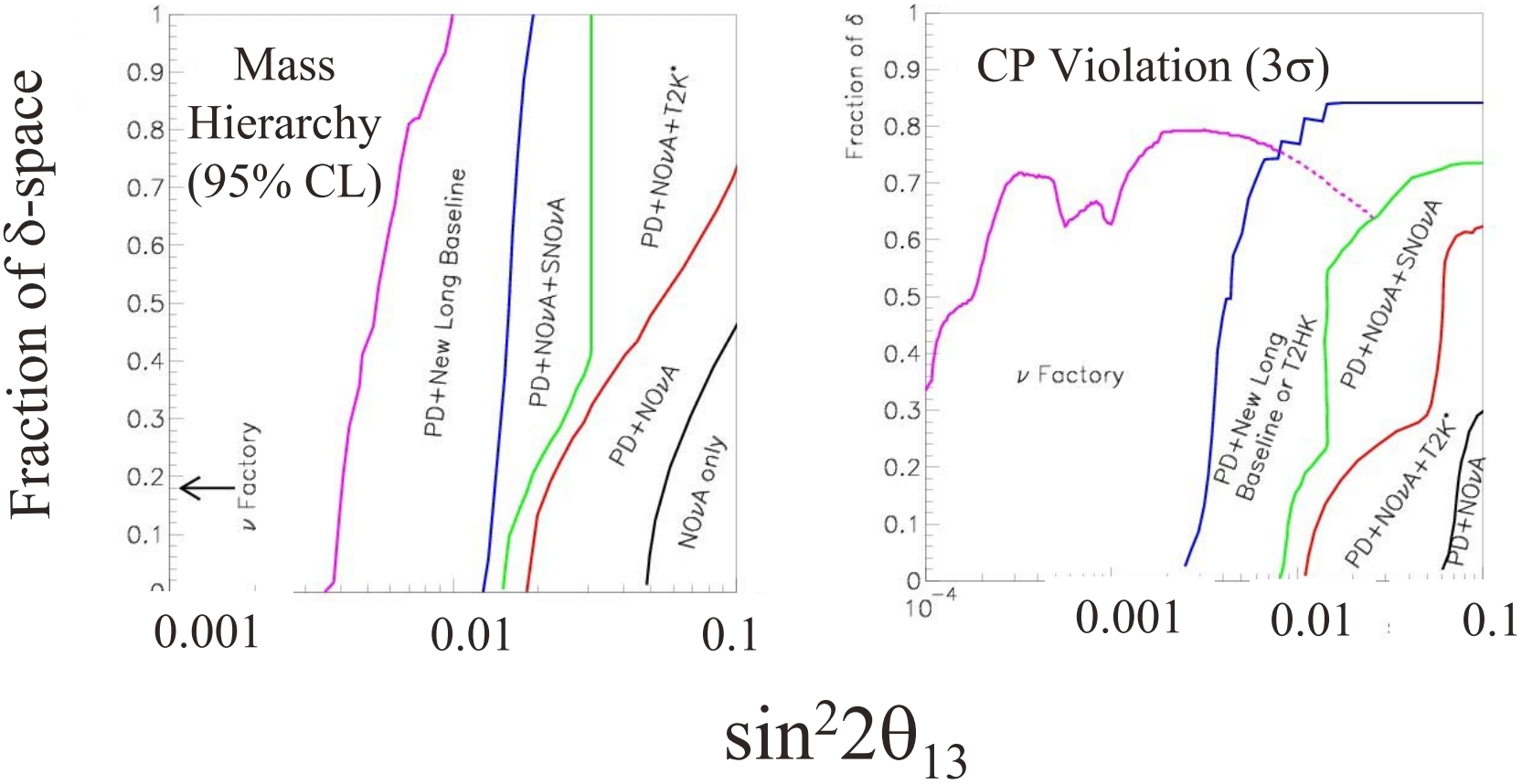
We have been approached by our INFN friends, who have suggested joint INFN/Fermilab organized Proton Driver meetings. After some discussion/encouragement from above we are proceeding with this …. Meeting will be on Elba, May 28th – 1st June. Fixing the dates is as far as we have got.

Articulating the Physics Case

Better articulating the physics case for a Proton Driver is an important output from workshops, documents, reviews etc

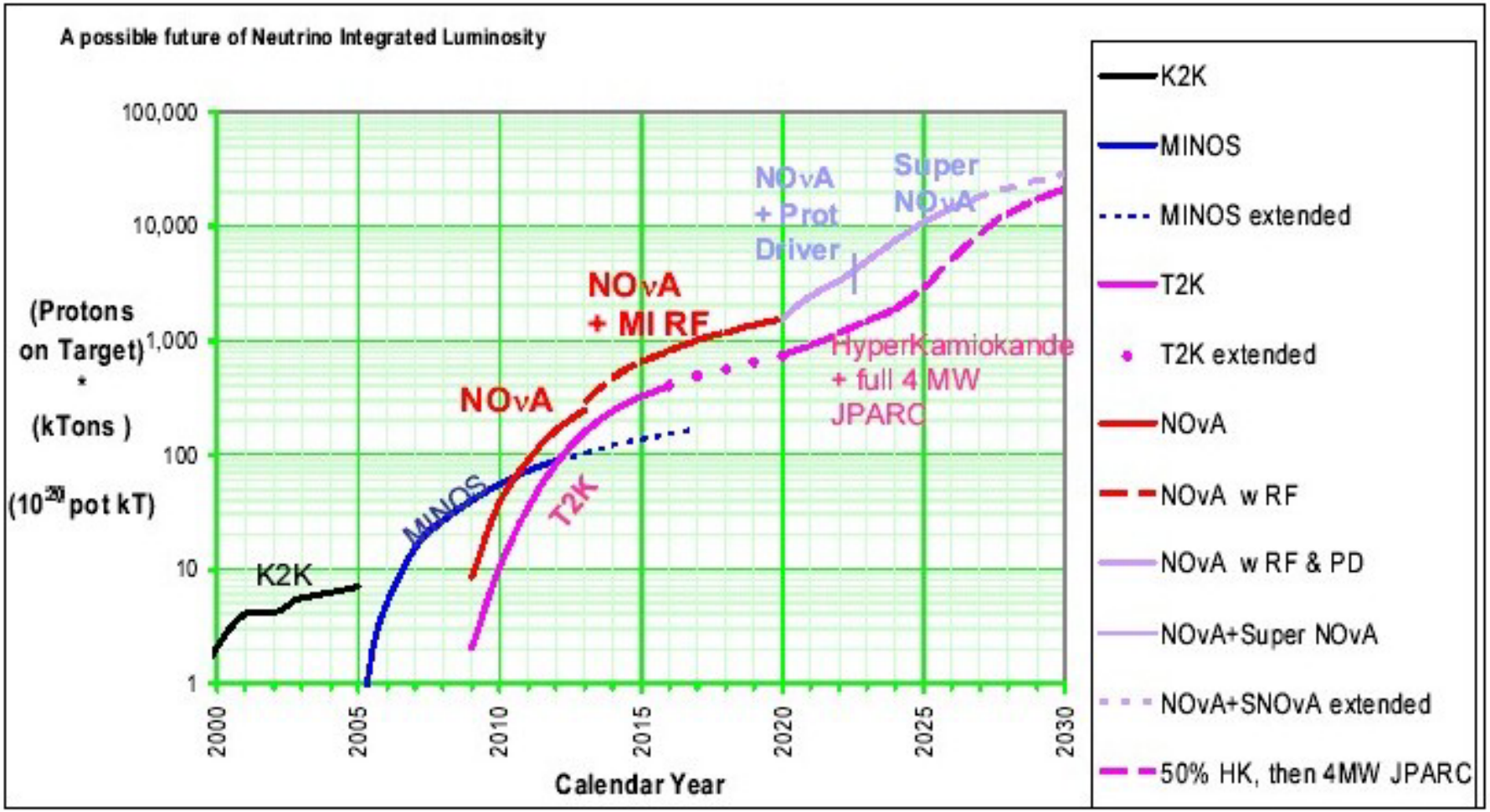
We are making progress, but additional/better plots to help make the case to our colleagues, other scientists, and the funding agencies is always welcome … there is room for more.

A Long-Baseline Fermilab Proton Driver Program would make Critical Contributions to the Global Program



In all scenarios it appears the Proton Driver has a critical role to play.

John Coopers NOvA Vison Plot



Getting Involved

Clearly an upgraded Fermilab Proton Driver is of great interest to NOVA proponents … and many of the contributions needed for making the case for a Proton Driver are coming from NOVA collaborators.

The Proton Driver needs your help !

We have weekly general Proton Driver meetings in 1 West on Wednesdays at 2pm … you are welcome.

Web Page: http://protondriver.fnal.gov/